JSC MATERIALS AND FRACTURE CONTROL CERTIFICATION

PROJECT/SUBSYSTEM MANAGER: **EX / Mark Mcdonald** | REF: MATL – **01- - 084**

HARDWARE NAME: **Personal Radiation Protection System (PRPS)** | PART NUMBER: **See Table (Attached)**

APPLICABLE REQUIREMENTS:

Materials Requirements:

- ☒ NSTS 1700.7B, Safety Policy and Requirements for Payloads Using the Space Transportation System
- ☒ SE-R-0006D, Space Shuttle System Requirements for Materials and Processes
- ☐ SE-M-0096A, General Specification for Materials and Processes for JSC Controlled Payloads
- ☒ SSP 30233F, Space Station Requirements for Materials and Processes
- ☒ JSC 27301B, Materials Control Plan for JSC Flight Hardware
- ☐ Other:

Fracture Control Requirements:

- ☒ NASA-STD-5003, Fracture Control Requirements for Payloads Using the Space Shuttle
- ☒ SSP 30558C, Fracture Control Requirements for Space Station
- ☐ SSP 52005B, ISS Payload Flight Equipment Requirements and Guidelines for Safety-Critical Structures

- ☒ Flammability
- ☒ Toxicity
- ☒ Stress Corrosion Cracking
- ☒ Fracture Control
- ☒ Aging
- ☐ Atomic Oxygen/Ultraviolet
- ☐ Thermal Vacuum Stability
- ☐ Fluid Compatibility:
- ☒ Microbiological Resistance
- ☐ Other:

LOCATION:

- ☒ Orbiter Crew Cabin
- ☐ Orbiter Payload Bay
- ☒ Progress
- ☒ Spacehab
- ☒ Soyuz
- ☒ MPLM
- ☒ Space Station: ☒ Internal ☐ External
- ☐ Other:

MATERIALS USAGE AGREEMENTS (MUA's):

- ☐ No MUA's
- ☒ MUA Number(s): **LM/ISS -56, Category 1.**

Deviation: **Flammability of the Ultra-High Molecular Weight Polyethylene Blocks**

LIMITATIONS: ☐ No Limitations

- ☒ Materials: **Rationale provided in MUA#LM/ISS-56 apply.**
- ☒ Fracture Control: **No Limitations**

This material certification is consistent with any existing Materials and Processes and Fracture Control Intercenter Agreements with MSFC, GSFC, JPL, and LeRC.

APPROVALS

Fracture Control Manager	Date	GFE Materials Control Manager	Date
JK for G. Ecord	1-11-01	J Kenney	1-11-01

Revised August 2000

ATTACHMENT 2

Attachment to MATL - 01 - 084

SEG 33114100-301	Radiation Shield Plate Assembly
SEG 33114109-301	Radiation Shield Corner Brick Assembly

ATTACHMENT 1

Hardware Acceptance Summary Report for Materials

The Personal Radiation Protection System (PRPS) will provide the crew with shielding from Ionizing radiation and consequently ensure a safe sleeping environment. The PRPS is an array of "Bricks", which are composed of 2 radiation protection panels mechanically fastened to form a single unit of 2 " thickness. Each panel is made of 1" thick Ultra high Molecular Weight polyethylene blocks (p/n Lennite) which are tightly wrapped with Al. tape (3M#425) for flammability protection. There is more than 1 " overlap between each wrap of tape. This Al. tape wrapped PE block is f urther encased in double layer Nomex HT-90-40 fabric pouch for additional Flammability protection. The mechanical fasteners used are CRES 300 series. The radiation shield is attached to the ISS structure by soft mounting with Velcroed Kevlar straps.

Stress Corrosion Cracking
All materials are "A" rated for SCC.

Flammability
A Category 1 Flammability MUA has been written and approved by EM / Dr. Mike Pedley and the ISS program to cover rationale that the 220 lbs of UHMWPE used for radiation protection does not create a Flammability hazard in the configuration used (Wrapped with Al. tape and Nomex). For the 1" wide, 0.037" thick Kevlar webbing, a configuration test (with the Kevlar loosely attached to the Double Layer Nomex softgoods cover in a "J" config. with ignitor at edge of webbing) was performed to study the potential for flammability hazard (Ref: W01-35932). The samples passed this configuration test in ISS environment (24.1%O2@14.5 psia). Hence, the Flammability of the straps has been covered bu ISS Category 3 rationale code 103. In the orbiter, this hardware will always be stowed inside non-flammable CTB bags, hence Flammability is a non-issue in Orbiter.

Toxicity
All materials are "A" rated or better for toxicity and used well below their maximum usage limits. The Lennite UHMWPE material has max. usage limit of 2592.66 lbs in ISS. The amount of Lennite used was 220 lbs approximately. The Kevlar straps are also used well below their max. usage limits. By MAPTIS data, similar Kevlar straps from same manufacturer are "K" rated for toxicity.
Hence this hardware is acceptable for toxicity.

Aging
This hardware was assessed for aging and found acceptable for 15 year life. The Nomex, Kevlar are all fairly resistant to aging. The Polyetheyelene is completely enclosed and in this configuration, aging due to light and UV is a non-issue.

Microbiological Resistance
The hardware was assessed for fungus and found acceptable based on the conditions of use. It is used in a controlled humidity environment and the only fungus prone material , Polyethylene is completely enclosed and has no probability of getting affected by moisture and fungus.

Conclusion
The only limitation is "Rationale provided in MUA#LM/ISS-56 apply."
There are no other limitations for the use of this hardware in ISS habitable areas.

DISTRIBUTION (JSC Materials and Fracture Control Certification MATL - 01 - 084)

NASA/JSC

EM/F. Benz
EX / Mark Macdonald

NASA/MSFC

EH02/D.E. Griffin

LOCKHEED MARTIN

B22/File Copy
B22/R. Gabiola
B22 / R. Dasgupta

TABLE 4-1. Fungi susceptibility of materials.

Group I - Fungus-inert materials (Fungus-inert in all modified states and grades)	
Acrylics	Polyamide 1/
Acrylonitrile-styrene	Polycarbonate
Acrylonitrile-vinyl-chloride copolymer	Polyester-glass fiber laminates
Asbestos	Polyethylene, high density (above 0.940)
Ceramics	Polyethylene terephthalate
Chlorinated polyester	Polyimide
Fluorinated ethylenepropylene copolymer (FEP)	Polymonochlorotrifluoroethylene
Glass	Polypropylene
Metals	Polystyrene
Mica	Polysulfone
Plastic laminates:	Polytetrafluoroethylene
Silicone-glass fiber	Polyvinylidene chloride
Phenolic-nylon fiber	Silicone resin
Diallyl phthalate	Siloxane-polyolefin polymer
Polyacrylonitrile	Siloxane polystyrene
Group II - Fungus nutrient materials (May require treatment to attain fungus resistance)	
ABS (acrylonitrile-butadiene-styrene)	Polyethylene, low and medium density (0.940 and below)
Acetal resins	Polymethyl methacrylate
Cellulose acetate	Polyurethane (the ester types are particularly susceptible)
Cellulose acetate butyrate	Polyricinoleates
Epoxy-glass fiber laminates	Polyvinyl chloride
Epoxy-resin	Polyvinyl chloride-acetate
Lubricants	Polyvinyl fluoride
Melamine-formaldehyde	Rubbers, natural and synthetic
Organic polysulphides	Urea-formaldehyde
Phenol-formaldehyde	
Polydichlorostyrene	

1/ Literature shows that under certain conditions polyamides may be attacked by selective micro-organisms. However, for military applications, they are considered group I.

5. Information for guidance only.

5.1 Process-related materials. Processing materials to be tested for fungus resistance in accordance with 4.4, such as paint, ink, coatings, adhesives, lubricants, viscous damping fluids, silicone grease, etc, should be prepared in the form of 50 mm squares or circles no more than 1.6 mm thick for testing. Liquid or paste materials should be prepared by impregnating to saturation a sterile sample of glass fabric.

5.2 Parts treatment. When treatment of parts is required to form fungus-resistant materials, a Moisture and Fungus Proofing (MFP) varnish conforming to MIL-V-173 may be applied in accordance with MIL-T-152 after the part is cleaned. The MFP varnish should not be applied to any part where the treatment will interfere with performance.

5.3 Carcinogens. Certain chemicals have been identified in the Occupational Safety and Health Act (OSHA) as cancer-producing substances (carcinogens). Before using any materials which might contain these chemicals, they should be evaluated in accordance with 29 CFR 1910. Consideration of the toxicity of a substance should be given prior to material selection.

ISS GFE MATERIALS USAGE AGREEMENT	USAGE AGREEMENT NO.	REV.	PAGE 1 OF 2
	LM/ISS-56	-	

TITLE:	CATEGORY:	EFFECTIVITY:
ISS Personal Radiation Protection (PRP) System Radiation Protection Block	1	ISS 5A.1 and Subs.

TYPE OF DEVIATION:	REQUIREMENT DEVIATED:
☐ MATERIAL ☒ EQUIPMENT (NO. PER VEHICLE:)	☒ FLAMMABILITY ☐ TVS ☐ SCC ☐ OFFGASSING ☐ O_2 COMPATIBILITY ☐ OTHER

EQUIPMENT	PART NUMBER	MANUFACTURER
Radiation Shield UHMW Block	SDG 33114106-001	NASA-JSC-EX

MATERIAL	TRADE NAME	SPECIFICATION	MANUFACTURER
Ultra High Molecular Weight Polyethylene	Lennite UHMW-PE	ASTM D-4020	Westlake Plastics

THICK (in.)	WEIGHT (lbs.)	AREA (in^2)	LOCATION	ENVIRONMENT		
				TEMPERATURE (°F)	PRESS (PSIA)	MEDIA
2x1.000	220 lbs app.	6630 app.	☒ HABITABLE ☐ NONHABITABLE	35 to 115 F	7.5 to 15.2 psia	30% O2

APPLICATION (use second sheet if required)

The Radiation protection Blocks or "Bricks" are the core of the ISS Personal Radiation Protection System (PRPS). When on-orbit with other elements of the Space Station, the PRPS will provide the crew with shielding from Ionizing Radiation and consequently ensure a safe sleeping environment. Each brick is composed of two Radiation protection panels mechanically fastened to form a single unit of combined thickness of 2 ". The Flat brick shown in Figure 1 is 15"x15"x2". The corner brick shown in Figure 2 is is 15"x4"x4". A configuration diagram is shown in Figure 3. Fourteen total flat bricks are used: 8 for the back wall and 3 for each side wall. In addition, 6 corner bricks are used to attach the side walls to the back wall. Each radiation protection panel is made of UHMW Polyethylene (p/n Lennite) wrapped entirely with Flame Resistant Aluminum Tape (p/n 3M#425) with 0.75" to 1.25" overlap between each wrap. Each aluminum wrapped panel is completely encased inside a Flame resistant Softgoods cover made of two (2) layers of Nomex HT-90-40 fabric.

RATIONALE (use second sheet if required)

The rationale for acceptance are as follows:
(a) Aluminum Tape (with acrylic adhesive backing) is adhered on each polyethylene block with 0.75" to 1.25" overlap. In this configuration, the Al. tape and polyethyelene is one integral unit with no exposed Polyethylene surfaces. Al. tape is an excellent flame barrier. Previous test data (Ref: WSTF 85-18799, WSTF84-17634, NSTS 22648) indicates that the Al. tape overwrap adequately protects flammable plastics from flammability hazards in 30%O2@ 10.2 psia environment. The Al. tape provides the primary level of protection from flammability.
(b) The Softgoods Cover made of Nomex HT-90-40 fabric provides additional levels of protection from flammability. Previous test data (Ref: WSTF # 99-34120) indicates that the Nomex fabric is non-flammable in single layer configuration in 10.2 psia, 30%O2 environment. Hence, the cover made of double layer hemmed Nomex is expected to be completely flame resistant in the above environment.

APPROVALS

ORIGINATOR/ORGANIZATION	DATE	JSC MATERIALS AND PROCESSES TECHNOLOGY BRANCH	DATE
(R. Dasgupta)	01/5/01	M.D. Kelley	1/5/01
PROJECT MANAGER	DATE	PROGRAM MANAGER	DATE
Mark Mc Donald	1/5/01		1/17/01

TITLE:	CATEGORY:	EFFECTIVITY:
ISS Personal Radiation Protection (PRP) System Radiation Protection Block	1	ISS 5A.1 and Subs.

APPLICATION (Contd.)

Ultra-High Molecular Weight Polyethylene is flammable in ISS environment (24.1%O2@14.5 psia). This Materials Usage Agreement provides rationale that the above configurationof the Radiation Protection Brick is not a credible flammability hazard in the ISS and Orbiter Crew Cabin environment.

RATIONALE (Contd.)

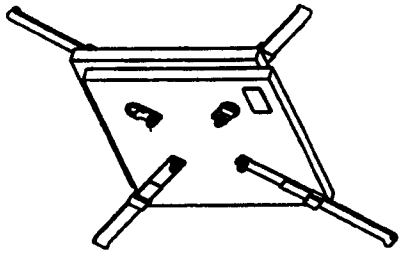
(c) Ultra-High Molecular Weight Polyethylene is the only suitable material for providing shielding from Ionizing radiation, as it has adequate radiation absorbing characteristics.

(d) The radiation shield is unpowered and the presence of a credible external ignition source is highly unlikely in the Crew Sleeping quarters where the PRPS will be located.

Due to all of the above reasons, the above configuration of the Radiation shield is not a credible flammability hazard in the ISS and Orbiter Crew Cabin environment.

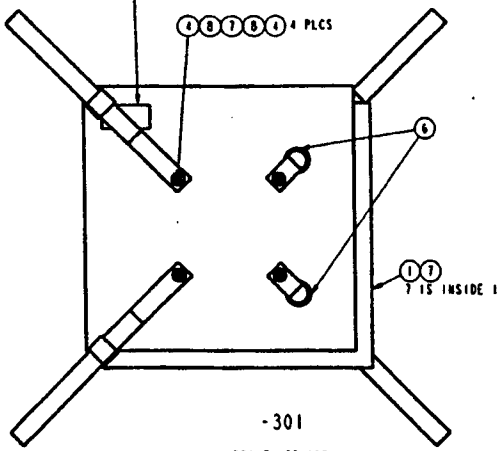
FIGURE 1

SEWN SEEMS OF ITEMS 1 AND 2 ARE POSITIONED TO FACE EACH OTHER DURING ASSEMBLY.

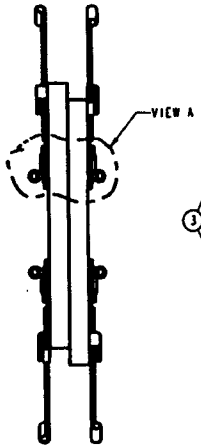


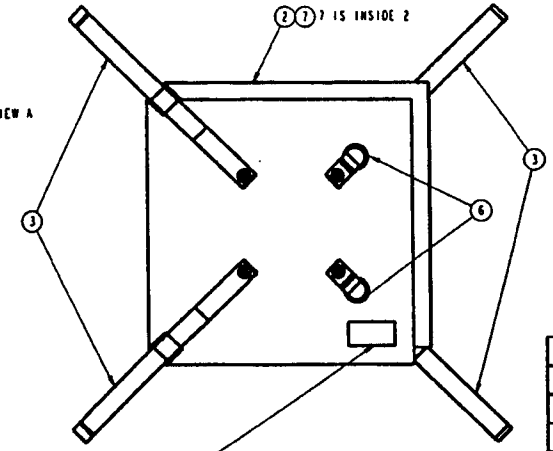
ISOMETRIC VIEW
REFERENCE ONLY

1 A | RADIATION SHIELD PLATE ASSY
PART NO. 33114100
SER NO. 1XXX



-301
SCALE 33:100





1 B | RADIATION SHIELD PLATE ASSY
PART NO. 33114100
SER NO. 1XXX

QTY	PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION	ITEM
8	98019A355	SPACER, WASHER	.625 OD X .251 ID X .01 SS18-8	MS15795	8
4	SDG33114108-001	PIN, SHIELD PLATE			7
2	SDG33114106-001	RADIATION SHIELD GUARD BLOCK			6
4	SEG33114101-302	D-RING STRAP ASSY			5
8	90905A651	SPLIT RING	OD .55 X ID .45 SS300		4
4	SEG33114101-301	VELCRO STRAP ASSY			3
1	SEG33114102-702	COVER, RADIATION SHIELD BLOCK SEAM			2
1	SEG33114102-701	COVER, RADIATION SHIELD BLOCK SEAM			1
X	-301	RADIATION SHIELD PLATE ASSY			

5. BREAK ALL SHARP EDGES AND ROUND ALL CORNERS TO .02 - .04 R.
4. ALL DIMENSIONS ARE IN INCHES/POUNDS.
3. CLEAN TO LEVEL GC PER NASA/JSC PRC-5001.
2. FABRICATION TOLERANCES AND PRACTICES PER SKZ-36103755.
1. INTERPRET PER JPG 8500.4.

1 RUBBER STAMP PART NAME, NUMBER AND SERIAL NUMBER IN 1/8 HIGH GOTHIC CHARACTERS PER NASA/JSC PRC-9002. SIDE A AND B DESIGNATION TO BE RUBBER STAMPED IN 3/4 INCH HIGH GOTHIC CHARACTERS. LOCATE APPROXIMATELY AS SHOWN.

FLAG NOTES

SIGNATURES	DATE
DD G PIPER	27-Dec-00
ENG G PIPER	02-Jan-01
CD P STODDARD	02-Jan-01
APP	
QE	
MATL	
STRESS	
AUTH	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

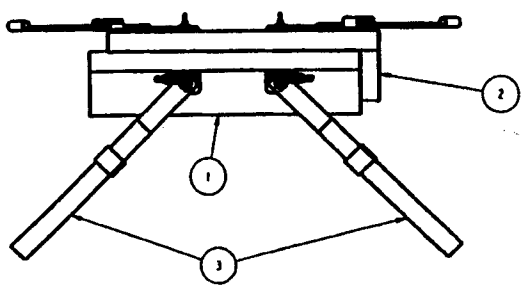
RADIATION SHIELD PLATE ASSY

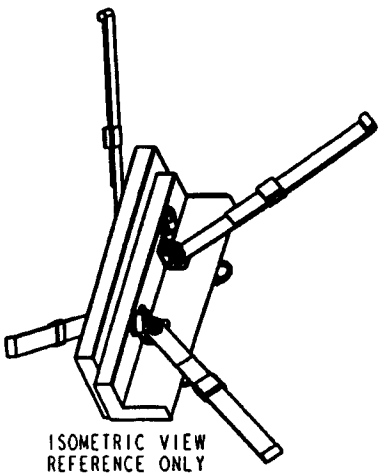
PROJECT TEMP RAD SHIELD

SIZE D | CAGE ID NO 21356 | DRG NO SEG33114100 | REV

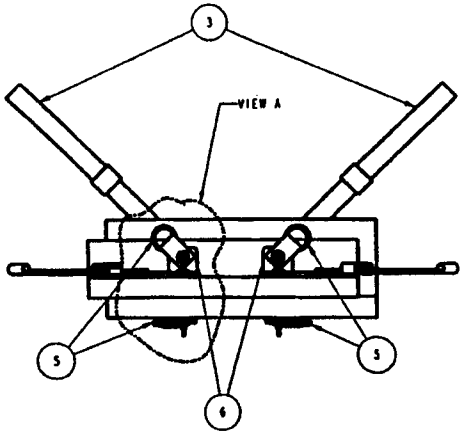
SCALE NOTED | DRN EB | SHEET 1 OF 2

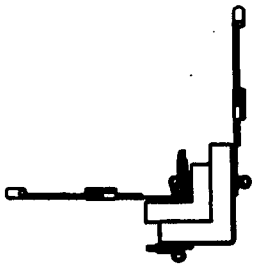
FIGURE 2



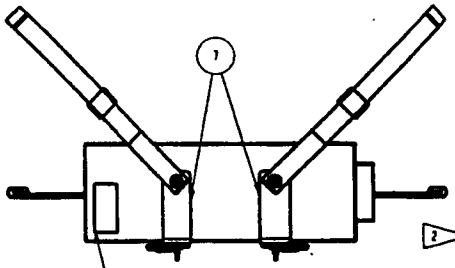


ISOMETRIC VIEW
REFERENCE ONLY
SCALE 1/3





-301
SCALE 1/3



1 CORNER BLOCK ASSY, RADIATION
PART NO. 33114109
SER. NO. 1XXX

QTY	PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION	ITEM
8	98019A355	SPACER, WASHER	.625 OD x .251 ID X .0 SS18-8	MS15795	9
4	SEG33114107-007	CORNER PIN			8
2	SEG33114107-006	EXTERNAL BRACE			7
2	SEG33114107-005	INTERNAL BRACE			6
4	SEG33114101-302	D-RING STRAP ASSY			5
2 8	90905A651	SPLIT RING	OD .55 X ID .45 SS300		4
4	SEG33114101-301	VELCRO STRAP ASSY			3
1	SEG33114117	CORNER EXTERNAL BLOCK ASSY			2
1	SEG33114115	CORNER INTERNAL BLOCK ASSY			1
X	-301	CORNER BLOCK ASSY RADIATION SHIELD			

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES; TOLERANCES: FRACTIONAL ±1/64, .XX ±.01, .XXX ±.005, ANGULAR ±1°; SURFACE FINISH 125 MICROINCHES RMS UNLESS NOTED OTHERWISE; BREAK SHARP EDGES; FRACTURE CRITICAL: YES / NO; NEXT ASSY SEG33114000; NX FILENAME 33114109.DWG

SIGNATURES	DATE
DD G PIPES	30-Dec-96
ENG G PIPES	
CH D STODDARD	
APP	
QE	
MAIL	
STRESS	
ADMIN	

FLT HDWE ☐ APPLICABLE GSE ☐ OTHER (SPECIFY)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER HOUSTON TEXAS

CORNER BLOCK ASSY
RADIATION SHIELD

PROJECT TEMP RAD SHIELD

SIZE D | CAGE CODE 21356 | DWG NO SEG33114109 | REV

SCALE NOTED | CONT CH | SHEET 1 OF 2

3. CLEAN TO LEVEL GC PER NASA/JSC PRC-5001.

2. FABRICATE TOLERANCES AND PRACTICES PER SKZ36103755.

1. INTERPRET PER JPG 8500.4.

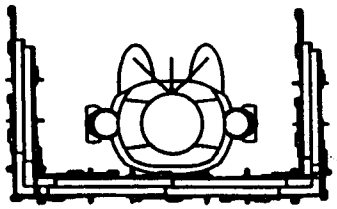
NOTES: UNLESS OTHERWISE SPECIFIED

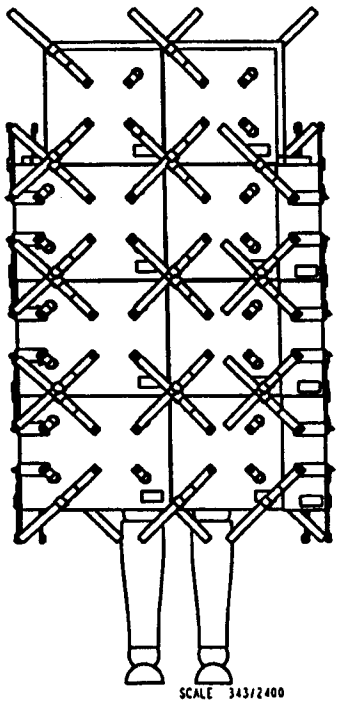
2 SOURCE IS MCMASTER-CARR, CHICAGO, IL.

1 RUBBER STAMP PART NAME, PART NUMBER AND SERIAL NUMBER IN 1/8 INCH HIGH GOTHIC CHARACTERS PER NASA/JSC PRC-9002. LOCATE APPROXIMATELY AS SHOWN.

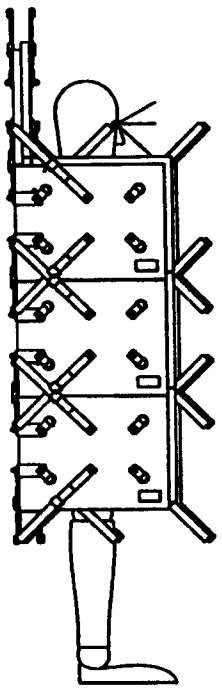
FLAG NOTES

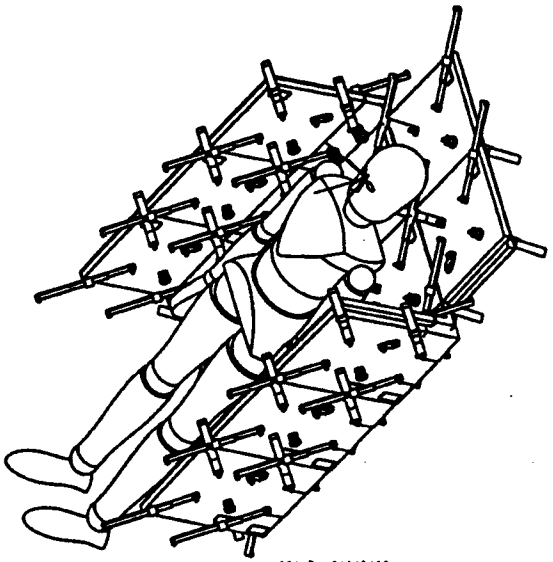
FIGURE 3





SCALE 343/2400





SCALE 343/2400

1		MALE 95TH PERCENTILE			3
6	SEG33114109	CORNER ASSY			2
14	SEG33114100	RADIATION SHIELD PLAT ASSY			1
		RADIATION SHIELD SLEEP CONFIG ASSY			
QTY	PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION	ITEM

DIMENSIONAL TOLERANCE UNLESS NOTED OTHERWISE	SIGNATURES	DATE	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
.0 ± .1 .00 ± .05 .000 ± .005	DR G PIPER	27-Dec-88	LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS
ANGULAR ± 1°	ENG G PIPER		RADIATION SHIELD SLEEP CONFIG ASSY
SURFACE FINISH TO BE MACHINED UNLESS NOTED OTHERWISE ✓	CH G STODDARD		PROJECT TEMP RAD SHIELD
FRACTURE CRITICAL ☐ YES ☒ NO	APP		
NEXT ASSY	QE		
USED ON	MATL		
APPLICATION	STRESS		
DWG FILENAME CORNER_SHELL_1.DWG	MFTH		SIZE CODE IDENT NO DI 21356 DWG NO SEG33114118 REV
☒ FLT HDWR ☐ APPLICABLE S&E ☐ OTHER (SPECIFY)			SCALE 1/10 WT LB SHEET 1 OF 1

3. CLEAN TO LEVEL GC PER NASA/JSC PRC-5001.

2. FABRICATE TOLERANCES AND PRACTICES PER SKZ36103755.

1. INTERPRET PER JPG 8500.4

NOTES: UNLESS OTHERWISE SPECIFIED

*** MAPTIS NONMETALLIC SELECTION LIST DATA FOR MTRL CODE: 82386 **** 21-MAY-01

MTRL CODE: 82386
USE TYPE: PLASTIC ULTRA HIGH MOLECULAR WEIGHT (UHMW)
DESIGNATION: LENNITE* UHMW
COMPOSITION: POLYETHYLENE
GENERIC ID: DKCFXXXX MFG SERVICE TEMPS IN AIR - MIN: MAX:

* LENNITE IS A REGISTERED TRADEMARK OF WESTLAKE PLASTICS

SPECIFICATION: ASTM D 4020-81

MANUFACTURER: WESTLAKE PLASTICS COMPANY

BASIC PROPERTIES

DATA SOURCE	SOURCE DATE
PRODUCT DATA SHEET	21-NOV-00

PROPERTY	VALUE	UNIT	COMMENTS
COEFFICIENT OF THERMAL EXPANS	11.0E-5	in/in F	PER ASTM D696
DENSITY	.03	lb/cu in	PER ASTM D792
DIELECTRIC CONSTANT	2.3		PER ASTM D150
ELONGATION	350	percent	PER ASTM D638
HARDNESS	61		ROCKWELL R
HEAT DEFLECTION TEMP		F	
MAX COUNTINUOUS TEMP		F	
REFRACTION INDEX			
TENSILE STRENGTH	6000	psi	PER ASTM D638
WATER ABSORPTION		percent	

TOXICITY DATA

TEST NR	CU #	SMP WGT grams	CHAMBER VOLUME liters	GAS NAME	OFFGASD AMOUNT MCR/GRM		SMAC	R	SHUTTLE ZT100	SHUTTLE ML WGT lbs	S R	ISSA ZT100	ISSA ML WGT lbs	RUSSIAN SMAC	R	RUSSIAN ZT100	RUSSIAN ML WGT lbs
W25631-A		22.433	4.3	ACETALDEHYDE	.008		4	K	.035	1428.6	K	.0193	2592.66	1	K	.0289	1732.65
				ACETONE	.006		50							2			
				BUTENES	.007		5										
				C10 SATURATED ALIPHATIC HYDROCARBONS	.02		43.5										
				C11 SATURATED ALIPHATIC HYDROCARBONS		*	47.9										
				C6 UNSATURATED ALIPHATIC HYDROCARBONS	.02		5										
				C7 SATURATED ALIPHATIC HYDROCARBONS	.04		200.28										
				CARBON MONOXIDE	.39		10							5			
				HEXANE	.42		176							5			
				ISOPROPYL ALCOHOL	.01		150							1.5			
				METHYL ETHYL KETONE	.01		30							.25			
				OCTANE	.02		348.92							10			

NASA JSC TEST REQUEST

NOTE TO TEST FACILITY: A COPY OF THIS REQUEST SHOULD BE RETURNED WITH THE TEST REPORT.

OFFICE USE ONLY

TEST FACILITY I.D. NUMBER 91-25631 ✓

NAME	ORGANIZATION	COORDINATOR
R. MCINTOSH/R. PELLITIER/ L. WONG	NASA/UNISYS/HUGHES EDD	BEM M.D.P.

ADDRESS

NASA/GSFC/732.2
GREENBELT, MD 20771

UNISYS-GSFC
GREENTECH BLDG.
10265 AEROSPACE RD.
GREENBELT, MD 20706

HUGHES AIRCRAFT CO.
ELECTRON DYNAMICS DIV
3100 WEST LOMITA BLVD
BLDG. 237, RM #1450
TORRENCE, CA 90509

REQUEST NO. 9567 C

TEST FACILITY WSTF

DATE	PHONE	CODE
November 14, 1991	(301) 794-2722/(310) 517-5285	

1. MANUFACTURER'S INDENTIFICATION (ITEM DESCRIPTION)	2. MANUFACTURER'S NAME
LENNITE ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE	WESTLAKE PLASTIC CO. (215) 459-1000

3. SPECIFICATION	4. CHEMICAL CLASS	5. GENERIC USE

6. CATEGORY NHB 8060.1 A, B, C	7. TEST REQUIRED 1 THRU 18, VCM, TQCM, SPECIAL
NHB 8060.1C	7

8. VEHICLE	9. PART NUMBER & SERIAL NO.	10. PROJECT	11. USE TEMPERATURE
SHUTTLE		HEAT PIPE PERFORMANCE EXPERIMENT	

12. USE ATMOSHPERE/FLUID	13. IGNITER TYPE	14. USE PRESSURE	15. USE THICKNESS

16. INTENDED APPLICATION	17. QUANTITY IN HABITABLE AREA/HAZARDOUS FLUID/VACUUM

18. CURE TIME	19. CURE TEMPERATURE	20. CURE PRESSURE

21. TEST ARTICLE WT.	22. TEST ARTICLE AREA	23. NUMBER OF ITEMS TESTED	24. NUMBER ITEMS TO BE FLOWN

25. TEST CHAMBER VOLUME	26. TEST CHAMBER ATMOSPHERE	27. TEST CHAMBER PRESSURE	28. TEST CHAMBER TEMPERATURE
	25.9% O_2	11.8-12 PSIA	

29. TEST CHAMBER DURATION	30. CLEANING SPEC	31. MATL CODE	32. PHOTOGRAPHIC COVERAGE
			NONE

33. SPECIAL INSTRUCTIONS

RETURN ASSEMBLED ITEMS TO:
L. WONG
HUGHES AIRCRAFT CO.

JSC FORM 2035

AUTHORIZATIONS, SPECIAL INSTRUCTIONS, AND NOTES

FROM	DATE	INSTRUCTIONS
WSTF	--	NHB 8060.1B Test 7 was performed rather than the specified NHB 8060.1C Test 7.
Marburger, Bettye E. JSC	11/27/91	Disregard the return note on the test request.

NASA HANDBOOK 8060.1B
TEST 7: DETERMINATION OF OFFGASSED PRODUCTS

TEST MATERIAL

LENNITE ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE

TEST SAMPLE DESCRIPTION

Weight: 22.433 g

Preparation Information

The sample had a surface area of approximately 53 square centimeters.

TEST CONDITIONS

Test Chamber Volume: 4.3 liters

Test Atmosphere: 74.1% Nitrogen
25.9% Oxygen

Test Pressure: 82.0 kPa (11.9 psia)

Test Temperature: 49 °C (120 °F)

Test Duration: 72 Hr

TEST RESULTS, OBSERVATIONS, AND COMMENTS

TABLE 1. TEST RESULTS

Component	NASA Code	Toxic Limit (micrograms /gram)	Quantity (micrograms /grams)
Acetaldehyde	020300	77.1	0.008
Acetone	110500	1018	0.006
Butene	097600	7.17	0.007
C10 Saturated aliphatic hydrocarbon	099220	7.17	0.02
C11 Saturated aliphatic hydrocarbon	099460	7.17	0.003
C6 Unsaturated aliphatic hydrocarbon	098220	7.17	0.02
C7 Saturated aliphatic hydrocarbon	098500	287	0.04
Carbon monoxide	161000	40.9	0.39
Hexane	094200	252.21	0.42
Isopropyl alcohol	016400	140	0.01
Methyl ethyl ketone	115000	84.3	0.01
Octane	095850	500	0.02
Toluene	035200	108	0.008
Xylenes	039100	124	0.005

NASA QUALITY ASSURANCE: 

DATE: DEC 26 '91

MTRL CODE: 61461
USE TYPE: TAPE ADHESIVE
DESIGNATION: SCOTCH* 425
COMPOSITION: ALUMINUM WITH ACRYLIC ADHESIVE
GENERIC ID: DYFKAKXX MFG SERVICE TEMPS IN AIR - MIN: -65 f MAX: 300 f

* SCOTCH IS A REGISTERED TRADEMARK OF 3M CO

SPECIFICATION: DIN 2215L-T-808
L-T-80B
MIL-T-11291
MIL-T-23397B TYPE 2

MANUFACTURER: 3M CO
DIVISION: INDUSTRIAL TAPE AND SPECIALTIES

BASIC PROPERTIES

DATA SOURCE	SOURCE DATE
PRODUCT DATA SHEET	05-APR-01

PROPERTY	VALUE	UNIT	COMMENTS
DENSITY		lb/cu in	
DIELECTRIC STRENGTH		volts/mil	
ELONGATION	7.0	percent	
PEEL STRENGTH	3.4	lb f/in	
SERVICE TEMPS	300	F	
SHEAR STRENGTH		psi	
SHELF LIFE		days	
TENSILE STRENGTH	6977	psi	

TOXICITY DATA

TEST NR	CU #	SMP WGT grams	CHAMBER VOLUME liters	GAS NAME	OFFGASD AMOUNT MCR/GRM	SMAC	R	SHUTTLE ZT100	SHUTTLE ML WGT lbs	S R	ISSA ZT100	ISSA ML WGT lbs	RUSSIAN SMAC	R	RUSSIAN ZT100	RUSSIAN ML WGT lbs
W16661-B		20.09	4.3	** C8 SAT/UNSAT ALIPHATIC HYDROCARBONS	.2	35	K	.0295	1693.57	K	.0163	3073.53		K	.0946	528.798
				ACETALDEHYDE	.03	4							1			
				ACETONE	.08	50							2			
				C7 SAT/UNSAT ALIPHATIC HYDROCARBONS	.2	201										
				CARBON MONOXIDE	.2	10							5			
				ISOPROPYL ALCOHOL	.5	150							1.5			
				METHYL ETHYL KETONE	.07	30							.25			
				TOLUENE	.05	60							8			

TEST NR	T	DESCRIPTION/REMARK
W16661-B	R	BATCH/LOT 4253UAL32342

ODOR DATA - NHB TEST 6

TEST NR	CUR NR	R	SMP WGT grams	PCT OXY	PRESS psia	TEMP f	SUBSTR ODOR	THK in	SUBSTRATE MTRL

(TYPE OR PRINT, USING BLACK INK)

NASA JSC MATERIALS TEST REQUEST

(See instructions on reverse side)

TEST FACILITY I.D. NUMBER: 83-16661

TEST REQUEST (To be completed by Test Requestor)

NAME: Mel Steinthal

ORGANIZATION: ESS

ADDRESS: NASA/JSC Houston Texas

DATE: Oct 28 1983

PHONE: 713-483-3040

(Assigned by Test Coordinator)

COORDINATOR: RW2

JSC S/N: 4581A

TEST FACILITY: WSTF

CODE (Leave Space Blank):

1. MANUFACTURER'S IDENTIFICATION: No 425 Aluminum Tape

2. MANUFACTURER'S NAME: 3M

3. SPECIFICATION:

4. CHEMICAL CLASS: Al/Silicone

5. GENERIC USE: Tape

6. CHECK CATEGORY: [X] A [ ] B [ ] C [ ] D [ ] E [ ] F [ ] G [ ] H [ ] J

7. TESTS REQUIRED: [ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5 [ ] 6 [ ] 7 [ ] 8 [ ] 9 [ ] 10 [ ] 11 [ ] 12 [ ] 13 [ ] 14 [ ] 15 [ ] VCM [X] SPECIAL

8. VEHICLE: Shuttle

9. TEST DOCUMENT: NHB8060.1B

10. REQUESTER CONTRACT NUMBER:

11. USE TEMPERATURE:

12. USE ATMOSPHERE/FLUID:

13. IGNITER TYPE:

14. USE PRESSURE:

15. USE THICKNESS:

16. INTENDED APPLICATION:

17. QUANTITY IN HABITABLE AREA/HAZARDOUS FLUID/VACUUM: _____ LBS. _____ SQ. INCHES EXPOSED (If Known)

18. CURE TIME:

19. CURE TEMPERATURE:

20. CURE PRESSURE:

21. SPECIAL INSTRUCTIONS AND GENERAL DESCRIPTION OF SAMPLE

WSTF is requested to conduct a test No 7 rate study on this material. WSTF is requested to purchase 20 extra rolls to place in bonded stores

Per Mary McKee, JSC, 11/18/83 - Perform a standard NHB 8060.1B Test No. 6 and 7 under this request (WSTF No. 83-16661). Perform the special rate study under WSTF No. 83-16909, JSC No. 4742.

WSTF Note: A case of extra tape (24 rolls) is currently under procurement. Due to packaging requirements, 24 rolls could be purchased at a substantially lower price than 20 rolls. The extra tape will be placed in JSC Bonded Material Storage at WSTF upon arrival.

NOTE TO TEST FACILITY: A COPY OF THIS REQUEST SHOULD BE RETURNED WITH THE TEST REPORT

JSC FORM 20318 (REV. MAY 78) SUPERSEDES MSC FORM 20318 (REV. DEC. 70)

NASA-JSC

MATERIAL NAME:	3M No. 425 Aluminum Tape
MANUFACTURER:	3M Corporation Industrial Tape Division 220-8E 3M Center St. Paul, MN 55144
SUPPLIER:	Dixon Paper Co. P. O. Box 26608 Ranchland Sta. El Paso, Texas 79926
BATCH/LOT NUMBERS:	4253UAL32342
MANUFACTURER CURE (if any):	None Reported

NASA QUALITY ASSURANCE: _____

DATE: JUN 20 '84

Test No. 6

ODOR TEST

Test Atmosphere: 25.9% Oxygen and 74.1% Nitrogen

Test Chamber Volume	Material per liter of Test Chamber Volume	Total Soak (Hr)	Sample Withdrawal at 12.3 psia
2 Liters	300 sq cm	72 @ 120°F	

ODOR SAMPLE CONCENTRATION AND TEST RESULTS

1 part to 29 parts matrix gas	1 part to 9 parts matrix gas	No Dilution
1.0	1.6	2.0

OBSERVATIONS AND COMMENTS:

Prior to test, a single layer of the two-inch-wide tape was applied with minimum overlap onto a tared, 10-mil aluminum substrate, then prepared per the NHB 8060.1B sample surface area classification.

Scores reported are the averages of a five-member panel.

NASA QUALITY ASSURANCE: _____

DATE: _____

CARBON MONOXIDE AND TOTAL ORGANICS

Test No. 7

Test Atmosphere: 25.9% Oxygen and 74.1% Nitrogen

Test Chamber Size	Soak Conditions	Sample Weight
4.3 liters	72 Hours @ 120 F	20.089 grams

Test Pressure (psia)	Carbon Monoxide (micrograms/gram)	Total Organics (as pentane) (micrograms/gram)
11.8 to 12.0	0.2	0.7

ANALYTICAL RESULTS:

Gas phase organic material in micrograms per gram:

Acetaldehyde	0.03
Acetone	0.08
Isopropyl alcohol	0.5
Methyl ethyl ketone	0.07
C7 Saturated and unsaturated aliphatic hydrocarbons	0.2
Toluene	0.05
C8 Saturated and unsaturated aliphatic hydrocarbons	0.2

OBSERVATIONS AND COMMENTS:

Prior to test, a single layer of the two-inch-wide tape was applied with minimum overlap onto tared, 10-mil aluminum substrates, then prepared per the NHB 8060.1B sample weight classification. The sample weight is calculated to exclude the aluminum substrates.

NASA QUALITY ASSURANCE: _____

DATE: _____

OFFICE USE ONLY

...copy of this request should be returned with test report.

TEST FACILITY I. D. NUMBER: 01-35932

NAME	ORGANIZATION	COORDINATOR
Mike Pedley / Rajib Dasgupta	NASA/JSC / Lockheed Martin	SC

ADDRESS		REQUEST NO.
NASA/JSC MAIL CODE: EM2 / OR Houston, Tx 77058	Lockheed Martin 2400 NASA Road One, B22 Houston, Tx 77058	12155 G TEST FACILITY WSTF

DATE	PHONE	CODE
January 10, 2001	(281)333-7043 / (281)244-7550	

1. MANUFACTURER'S IDENTIFICATION (Item Description)	2. MANUFACTURER'S NAME
Kevlar 29 Webbing 1" Nomex HT-90-40	Bally Ribbon Mills Stern and Stern

3. SPECIFICATION	4. CHEMICAL CLASS	5. GENERIC USE
	Aramid	ISS Radiation Shield Strap

6. CHECK CATEGORY NASA-STD-6001: ☐ A ☐ B ☒ C

7. TEST REQUIRED NASA STD-6001: ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13 ☐ 14 ☐ 15 ☐ 16 ☐ 17 ☐ 18 ☐ VCM ☐ TSCM ☐ SPECIAL ☐ VAC BAKE

8. VEHICLE	9. PART NUMBER & SERIAL NO.	10. PROJECT	11. USE TEMPERATURE
ISS		ISS	

12. USE ATMOSPHERE/FLUID	13. IGNITER TYPE	14. USE PRESSURE	15. USE THICKNESS

16. INTENDED APPLICATION	17. QUANTITY INHABITABLE AREA/HAZARDOUS FLUID/VACUUM

18. CURE TIME	19. CURE TEMPERATURE	20. CURE PRESSURE

21. TEST ARTICLE WEIGHT	22. TEST ARTICLE AREA	23. NUMBER OF ITEMS TESTED	24. NUMBER OF ITEMS TO BE FLOWN

25. TEST CHAMBER VOLUME	26. TEST CHAMBER ATMOSPHERE	27. TEST CHAMBER PRESSURE	28. TEST CHAMBER TEMPERATURE

29. TEST CHAMBER DURATION	30. CLEANING SPEC	31. MATERIAL CODE	32. PHOTOGRAPHIC COVERAGE
			☐ VIDEO ☒ STILLS ☐ NONE

33. SPECIAL INSTRUCTIONS

Perform Flammability Test 1 on the supplied Kevlar samples (15" length) in 24.1 %O2@ 14.6 psia.
Perform in "J" configuration. The configuration of samples is as follows:
a) Stitch two pieces of Nomex HT-90-40 fabric along edges. Each piece of dimension 15" x3"
b) Loosely attach the Kevlar webbing on to the centerline of the outer layer of Nomex fabric by stitching at 2 to 3 locations along the 15 inch. length.
c) With this configuration , (inner to outer) : Nomex / Nomex / 1" kevlar / Igniter, Ignite the sample in J configuration at centerline of Kevlar webbing.

This test is highly urgent to support ISS 5A. Please expedite within 2-3 days. Any question, please call rajib dasgupta directly at 281-333-7043.

JSC Form 2039

AUTHORIZATIONS, SPECIAL INSTRUCTIONS, AND NOTES

FROM	DATE	INSTRUCTIONS
WSTF	--	The correct material identification is Kevlar 29 Webbing 1" applied to Nomex HT 90-40.
Dasgupta, Mr. Rajib Lockheed Martin Space Mission Systems & Services	01/10/01	Prepare the samples in accordance with the provided sketch. Position the igniter off-center below one of the edges of the Kevlar webbing.

NASA HANDBOOK 8060.1C
TEST 1: UPWARD FLAME PROPAGATION
NON-STANDARD TEST *

ASSEMBLED ARTICLE

Kevlar 29 Webbing 1" applied to Nomex HT 90-40

TEST ARTICLE DESCRIPTION

TABLE 1. SAMPLE MEASUREMENTS

Sample Measurements	Sample 1		Sample 2		Sample 3	
	SI	Cust.	SI	Cust.	SI	Cust.
Length * (cm, in.)	38.1	15.0	38.1	15.0	38.1	15.0
Thickness (cm, in.)	0.19	0.08	0.20	0.08	0.20	0.08
Weight (g, g)	29.44	29.44	30.33	30.33	30.38	30.38
Width * (cm, in.)	7.6	3.0	7.6	3.0	7.6	3.0

Preparation Information

The samples were configurational. *

The samples were prepared as requested.

Because of the resiliency of the test material, sample thickness could only be reliably measured to the nearest 0.01 cm.

Mounting Device: Needle Rake

Pretest Photograph(s): NASA-WSTF 0101-0033 0101-0034

TEST CONDITIONS

Test Atmosphere: 75.9% Nitrogen
24.1% Oxygen

Test Pressure: 100.0 kPa (14.5 psia)

Test Chamber Volume: 1.4 m^3 (50 ft^3)

Additional Information

The samples were mounted in a "J" configuration. The side of the sample with the Kevlar 29 Webbing was directed toward the igniter as shown in the pretest photographs. The long leg of each sample was approximately 27.9 cm (11.0 in.) long and the short leg was approximately 5 cm (2.0 in.) long with a bend radius of approximately 2.5 cm (1.0 in.). The igniter was placed 0.6 cm (1/4 in.) off center toward one edge of the Kevlar 29 Webbing and 0.6 cm (1/4 in.) below the front leading edge of the long leg of the "J". *

TEST RESULTS, OBSERVATIONS, AND COMMENTS

TABLE 2. TEST RESULTS

Results	Sample 1		Sample 2		Sample 3	
	SI	Cust.	SI	Cust.	SI	Cust.
			Side A			
Burn Length (cm, in.)	0.0	0.0	0.0	0.0	0.0	0.0
			Side B			
Burn Length (cm, in.)	0.0	0.0	0.0	0.0	0.0	0.0
			Measured Changes			
Weight Loss (g, g)	0.20	0.20	0.38	0.38	0.34	0.34
Relative O_2 Consumption (%, %)	ND	ND	ND	ND	ND	ND

Note(s): The side of each sample with the Kevlar 29 Webbing was designated Side A; the side without Kevlar 29 Webbing was designated Side B.

Propagation burn time is only reported if the material burns greater than 15.2 cm (6.0 in.).

ND indicates that the results were less than the reporting limit. The reporting limit for relative oxygen consumption is 0.5 percent.

TABLE 3. FLAMMABILITY CHARACTERISTICS
(NONE, SMALL, MODERATE, LARGE)

Characteristics	Sample 1	Sample 2	Sample 3
Quantity of Sparks	None	None	None
Quantity of Cinders	None	None	None
Quantity of Flame Jets	None	None	None
Quantity of Burning Material Transferred	None	None	None
Effect on K-10 paper	No Ignition	No Ignition	No Ignition

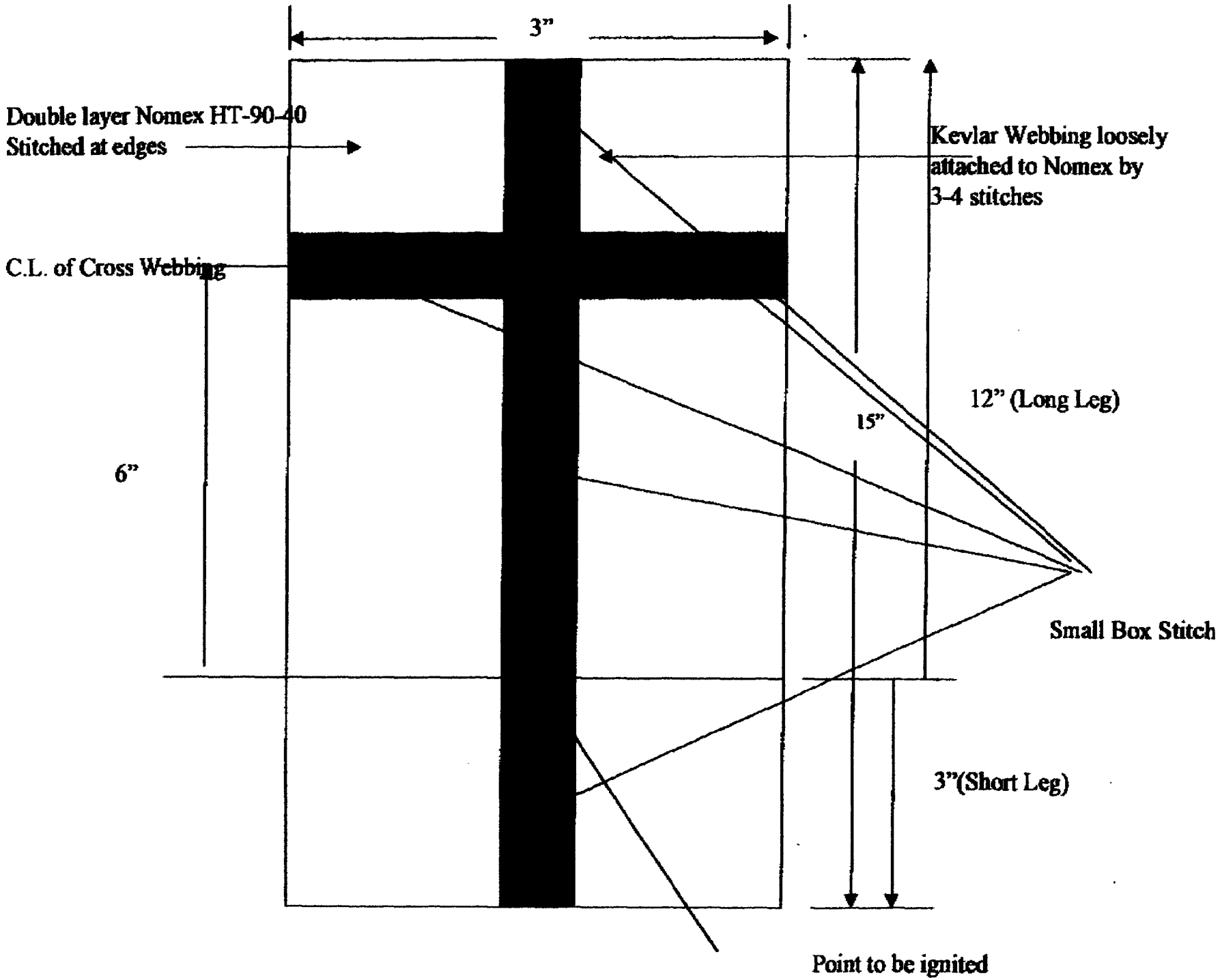
Posttest Photograph(s): NASA-WSTF 0101-0031 0101-0032

Video Cassette Number(s): 000-0341-A

Observations and Comments

None of the samples ignited.

Side A of the long legs of Samples 1, 2, and 3 were charred and discolored within the igniter flame impingement area. Side B of the long legs of Samples 1, 2, and 3 were discolored from the igniter flame on Side A; therefore, the posttest photographs do not appear to agree with the recorded burn lengths.



Lennite® UHMW-PE

(ultra high molecular weight polyethylene)

Westlake Product Bulletin

Lennite UHMW-PE is a low friction engineering plastic with excellent chemical resistance and abrasive wear resistance. Lennite is widely used in conveyors, packaging machinery, and food processing machinery since it is inherently low friction, wears well, and is not abrasive to mating parts. Westlake Plastics manufacturers Lennite with extremely low levels of residual stress so that it can be machined into complex parts with minimal deformation. It is often used to line or replace abrasion-resistant steel plate in bulk material handling applications when low friction, corrosion resistance, and excellent wear properties are essential. Natural (white) Lennite is **FDA compliant** for use in food processing machinery.

The following physical property information is based on typical values of the base ultra-high molecular weight polyethylene resin.

	Units	ASTM Test	Result
Mechanical			
Hardness-Shore D	—	D2240	D61
Izod Impact Strength			
Double 15° Notch @73°F	ft•lbs/in	D256	18
Tensile Elongation			
@break	%	D638	>350.0
@yield	%	D638	—
Tensile Strength			
@break	psi	D638	6,000
@yield	psi	D638	2,800
Thermal			
Coefficient of Thermal Expansion	in/in/°F	D696	11.0×10^{-5}
Heat Deflection Temperature @66 psi	°F	D648	203
Electrical			
Dielectric Constant @60Hz	—	D150	2.30
Dielectric Strength	V/mil	D149	2,300
Dissipation Factor			
@50Hz	—	D150	0.00019
@100kHz	—	D150	0.00025
Volume Resistivity	ohm•cm	D257	$>10^{16}$
Other			
Specific Gravity	—	D792	0.930
Water Absorption @24 hours	%	D570	Nil

Lennite Star Wheel

Industry Applications Include:

- Packaging and food processing machinery components
- Star wheels and guide rails
- Idler sprockets
- Timing screws
- Hopper, chute, truck bed, and railcar liners
- Conveyor components
- Bearings and bushings
- Under-chain wear strips

Advantages of Lennite:

- Excellent abrasive wear resistance
- Low friction
- Promotes the flow of bulk material (sand, soy beans, coals, etc.)
- Low moisture absorption
- High impact strength – even at cold temperatures
- Excellent chemical resistance
- FDA and USDA compliant (natural only), 3A Dairy, NSF Standards 51, 61
- Low cost

Manufacturing Capabilities:

Rod:	¼" to 4" diameter
Sheet:	⅛" to 6" thick
Tube:	1⅛" to 3½" O.D.

Colors/Grades:

Lennite – FDA Compliant (natural)
Lennite II – non-FDA (natural, gray and black)
Lennite XL – Cross linked (gray)
Custom colors available in both FDA compliant and non-FDA grades.

*In addition to our standard capabilities, Westlake also has the ability to process custom resins in various sizes and colors with some exceptions.

WESTLAKE PLASTICS COMPANY

World Headquarters
P.O. Box 127, Lenni, PA 19052
1-800-999-1700 • Fax: (610) 459-1064

www.westlakeplastics.com

West Coast Office
377 E. Chapman Ave., Suite 120, Placentia, CA 92870
1-800-440-0597 • Fax: (714) 961-0978

6-005 11/99

3M

Aluminum Foil Tape

425 • 427 Lined Version

1487

Technical Data **August 20, 1998**

Product Description

A 5 mil nominal dead soft aluminum foil backing combined with a transparent acrylic adhesive and an easy release liner (Tape 427 only). Tapes 425 and 427 have U.L. Approval Class "L" for low flammability. Can be used indoors or out for many long term applications.

Construction

Backing	Adhesive	Color	Liner	Standard Roll Length
Dead soft aluminum	Acrylic	Shiny silver	Easy release paper	60 yds. (55 m)

Typical Physical Properties and Performance Characteristics

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

			ASTM Test Method
Adhesion to Steel: Tape	425 427	47 oz./in. width (51 N/100 mm) 50 oz./in. width (55 N/100 mm)	D-3330
Tensile Strength:	425/427	30 lbs./in. width (525 N/100 mm)	D-3759
Backing Thickness:	425 427	2.8 mils (.072 mm) 3.1 mils (.079 mm)	D-3652
Total Tape Thickness:	425 427	4.6 mils (.116 mm) 4.8 mils (.122 mm)	D-3652
Liner Thickness:	427	3.1 mils (.08 mm)	D-3652
Elongation at Break:	425/427	8%	D-3759
Water Vapor Transmission Rate:	425/427	.1g H_2O/100 sq. in./24 hrs. (1.55 g/m^2/.24 hrs.)	D-3833
Approximate Weight:	425/427	0.115 lbs./yd./in. width (4.77 gms/m/24 mm)	

General Information

- 427 tape can easily be die-cut into special sizes or shapes.
- The very low moisture vapor transmission rate makes 425 and 427 tapes a good sealant.
- The acrylic adhesive combined with the durable aluminum backing offers ideal properties for long serviceable life both indoors and out.
- Good candidate as a maskant in electroplating of aluminum because it will not contaminate the bath.
- Aluminum backing provides excellent reflection of both heat and light.
- Can be certified to meet MIL-T-23397b, Type II.
- 425 tape has been tested and passed F.A.R. specification No. 25.853(a).

Aluminum Foil Tape

425 • 427 Lined Version

General Information *(continued)*

- Performance range from -65°F to 300°F (-54°C to 150°C). Higher temperatures for shorter periods.
- Store in a clean, dry place at 60-80°F (15-27°C) and 40-50% relative humidity no longer than 24 months from date of manufacture.
- Flame resistant. Meets U.L. 723, Class "L" Low Flammability Rating File R 7311.
- Best results obtained when applied to a clean, dry surface above 32°F (0°C).

IMPORTANT: The 3M™ 425 Aluminum Tape is not intended for medical usage. Neither 3M nor the Food and Drug Administration has evaluated or reviewed this tape for medical application. 3M does not recommend or endorse the usage of the aluminum tape for medical application. User assumes all risk and liability whatsoever in connection with usage of product in a medical application.

Application Ideas

- Aircraft paint stripping maskant.
- Moisture barrier in "white goods" appliances.
- General purpose heat reflector and heat dissipator.
- Mechanically hold wires and cooling coils in "white goods" appliances.
- Repair tears on truck trailers and aircraft.
- Splicing of thin gauge foils.
- General purpose holding, patching, sealing applications – indoors and out.

Features	Advantages	Benefits
• Aluminum foil backing	• Long term protection	• Helps protect parts from water, dust or chemical damage
	• Heat reflective	• Helps protect parts from heat
	• Flame resistant	• Will not support combustion
• Acrylic adhesive	• Long aging	• Helps reduce need for replacing

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Industrial Tape and Specialties Division, 3M Center, Building 220-7W-03, St. Paul, MN 55144-1000. Our fax number is 651-733-9175. In Canada, phone: 519-451-2500. In Puerto Rico, phone: 787-750-3000. In Mexico, phone: 52-5-270-0400.

Important Notice

3M MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. Please remember that many factors can affect the use and performance of a 3M ITSD product in a particular application. The materials to be bonded with the product, the surface preparation of those materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M ITSD product. Given the variety of factors that can affect the use and performance of a 3M ITSD product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M ITSD product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

Limitation of Remedies and Liability

If the 3M product is proved to be defective, THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M PRODUCT. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.

ISO 9002

This Industrial Tape and Specialties Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

3M

Industrial Tape and Specialties Division

3M Center, Building 220-7W-03
St. Paul, MN 55144-1000